

"Express Mail" mailing label number
 EL 500980774 US

Date of Deposit March 26, 2002

JC02 Rec'd PCT/PTO 26 MAR 2002

FORM PTO-1390 (REV. 5-93)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	CASE NO. 3716/138
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 10/089246	
INTERNATIONAL APPLICATION NO. PCT/US00/26572	INTERNATIONAL FILING DATE September 27, 2000	PRIORITY DATE CLAIMED September 27, 1999	
TITLE OF INVENTION FERROMAGNETIC INK TRACKS AND TOYS AND PROCESSES FOR MAKING SAME			
APPLICANT(S) FOR DO/EO/US Thomas W. T. Fung			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input checked="" type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)). <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input checked="" type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)) and/or amendments under Article 34. 			
Items 11. to 16. Below concern other document(s) or information included:			
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input type="checkbox"/> Other items or information: 			

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U.S. APPLICATION NO. 70 / 089246						INTERNATIONAL APPLICATION NO. PCT/US00/26572		CASE NO. 3716/138																																																				
17. <input checked="" type="checkbox"/> The following fees are submitted: Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO.....\$890.00 International preliminary examination fee paid to USPTO (37 CFR 1.492(a)(1)).....\$710.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.492(a)(2)).....\$740.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.492(a)(3)) paid to USPTO.....\$1,040.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4).....\$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)). <table border="1"><thead><tr><th>Claims</th><th>Number Filed</th><th>Number Extra</th><th>Rate</th></tr></thead><tbody><tr><td>Total Claims</td><td>14- 20 =</td><td></td><td>x \$ 18.00</td></tr><tr><td>Independent Claims</td><td>4- 3 =</td><td>1</td><td>x \$ 84.00</td></tr><tr><td colspan="3">Multiple dependent claim(s) if Applicable)</td><td>0 + \$280.00</td></tr><tr><td colspan="3">TOTAL OF ABOVE CALCULATIONS =</td><td>\$314</td></tr><tr><td colspan="4">Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28)</td></tr><tr><td colspan="3"></td><td>SUBTOTAL = \$</td></tr><tr><td colspan="4">Surcharge of \$130.00 for furnishing the English translation later than the <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).</td></tr><tr><td colspan="3"></td><td>TOTAL NATIONAL FEE= \$</td></tr><tr><td colspan="4">Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31), \$40.00 per property +</td></tr><tr><td colspan="3"></td><td>TOTAL FEES ENCLOSED= \$314</td></tr><tr><td colspan="3"></td><td>Amount to be refunded \$</td></tr><tr><td colspan="3"></td><td>charged \$</td></tr></tbody></table>						Claims	Number Filed	Number Extra	Rate	Total Claims	14- 20 =		x \$ 18.00	Independent Claims	4- 3 =	1	x \$ 84.00	Multiple dependent claim(s) if Applicable)			0 + \$280.00	TOTAL OF ABOVE CALCULATIONS =			\$314	Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28)							SUBTOTAL = \$	Surcharge of \$130.00 for furnishing the English translation later than the <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).							TOTAL NATIONAL FEE= \$	Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31), \$40.00 per property +							TOTAL FEES ENCLOSED= \$314				Amount to be refunded \$				charged \$	CALCULATIONS	PTO USE ONLY	
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Send All Correspondence to: Brinks Hofer Gilson & Lione P.O. Box 10395 Chicago, IL 60610				 Signature Vincent J. Gnoffo Name 44,714 Registration Number																																																								

FERROMAGNETIC INK TRACKS AND TOYS AND PROCESSES FOR MAKING THE SAME

BACKGROUND OF THE INVENTION

5 This invention relates to toy vehicles and tracks. More particularly, the invention relates to toy vehicles that can travel along a magnetic track on a play board using self-guiding mechanisms.

10 Play boards for various types of traveling toys that use magnetism to guide the toy along a metallic path on a game board are well known. Typically, a traveling toy, such as a toy train, follows a guide path which is made from a substrate of non-ferromagnetic material having embedded therein a ferromagnetic material in the form of wire or tape. The wire or tape is either affixed to the surface of the plate or is embedded in a groove carved in the surface of the plate. Often, a fanciful image depicting roadways and landscape is placed over the top of the plate and ferromagnetic material.

15 In typical operation, the toy vehicle has a pivoting magnet and guide wheel assembly at the forward end of the vehicle. A separate drive wheel propels the traveling toy forward or backwards. As the magnet at the forward end of the vehicle is attracted to the ferromagnetic guide path, the magnet and guide wheel assembly pivots in the direction of the path change causing the vehicle to turn into the direction of the path change.

20 Typically, the play boards are complicated and costly to produce. In addition, the traveling toys often include a large number of components which add to the cost of the toy. Therefore, there is a need for a new process for making play boards with a ferromagnetic guide path in a more efficient, less costly manufacturing process. Also, there is a need for more efficiently manufacturing the traveling toys, and making them with fewer parts.

SUMMARY OF THE INVENTION

25 The present invention, in one embodiment, provides a process for making a ferromagnetic guide path play board that includes the steps of providing a

supporting substrate, providing a ferromagnetic ink that includes iron powder, printing the ink onto the substrate, and applying a graphic image over the substrate.

5 The present invention, in a second embodiment, provides a magnetically guided traveling toy that includes a toy body, motor driven wheels at the rear of the body, and a magnetically guided wheel assembly at the forward end of the body. The magnetically guided wheel assembly includes a pivotable housing, a forward projecting arm, a magnet disposed at the end of the forward projecting arm, and one wheel having axis of rotation located perpendicular to and
10 intersecting with the pivot axis of the housing. Preferably, the housing is connected to the toy body such that the housing pivots to center automatically when the toy vehicle is lifted off of the playing board.

BRIEF DESCRIPTION OF THE DRAWINGS

15 FIG. 1 is an exploded perspective view of a magnetically guided toy vehicle.

FIG. 2 is an exploded perspective view of a second embodiment of a magnetically guided toy vehicle showing in detail the magnetically guided wheel housing and assembly.

20 FIG. 3 is an exploded perspective view of a third embodiment of a magnetically guided toy vehicle.

FIG. 4 is a perspective view of a play board with ferromagnetic tracks and a robot figurine traveling along the track.

FIG. 5 is a perspective view of a play board having ferromagnetic railroad tracks.

25 FIG. 6 is a perspective view of a play board for a toy automobile.

FIG. 7 is a perspective view of another embodiment of a play board for a toy automobile.

FIG. 8 is a perspective view of yet another embodiment of a play board in the form of a storybook with ferromagnetic tracks for a toy vehicle.

FIG. 9 is an exploded perspective cutaway view of various play boards with ferromagnetic tracks made according to various processes.

FIG. 10 is a perspective view of a play board with hidden ferromagnetic tracks, and a toy animal that is activated by movement across those ferromagnetic tracks.

FIG. 11 is a plan view of another embodiment of a play board.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 depicts one embodiment of a magnetically guided toy vehicle. The toy vehicle 10 includes a vehicle body 11 in which a motor gear box 12 is located. Preferably the motor gear box 12 is spring actuated. A windup knob 13 extends out of the gear box 12 and beyond the side of the vehicle body 11. The knob 13 provides the mechanical input means to windup the spring motor inside the motor gear box. The motor gear box 12 also includes a drive axle 14 that extends out both sides of the vehicle body. On the ends of the drive axle, wheels 15 are attached to drive the vehicle. A vehicle cap 16 is placed over the top of the gear box on top of the body to enclose the motor gear box. The motor gear box and drive wheels are located at the rear end of the vehicle.

At the forward end of the vehicle, there is a magnetically guided front wheel assembly 17. The wheel assembly 17 includes a front wheel holder 18 that is pivotally mounted into a vehicle body front wheel cylinder 19. The holder is held in the cylinder by a fastener 20 such as a large head screw, inserted in the top end of the wheel holder 18 through the cylinder. At the bottom end of the wheel holder 18 and inline with the pivot axis, a single front wheel 21 is located. The wheel rotates about a shaft 22, or axle, that is perpendicular to that holder pivot axis. The shaft 22 also extends beyond the wheel, through a yoke in the holder, and through apertures 23 in a magnet holder 24. The magnet holder 24 has an opening that fits around the outside of the front wheel holder 18 at the wheel axle. The axle 22 maintains the magnet holder 24 in a fixed position relative to the front wheel holder 18. This enables the magnet holder 24 to rotate with the front wheel

holder 18. The magnet holder 24 includes a projecting arm 25 extending forward, at the forward end of which a magnet 26 is placed on the lower side.

FIG. 1A depicts the components of the toy vehicle 10 assembled together in a cross-section view. From the cross-sectional view, it is apparent that the magnet 26 is suspended by the projecting arm 25 at about the same level as the bottom of the plane formed by the bottom of the wheels of the toy vehicle. The magnet 26 is located in close proximity to the play board on which the toy vehicle is intended to drive.

FIG. 2 depicts an exploded perspective view of a second embodiment of a toy vehicle 30. In this embodiment, a vehicle chassis 31 is provided that includes a mounting bracket 32 at the rearward end for mounting a motor gear box 33, such as a spring windup gear box. The spring windup gear box 33 includes a knob 34 for winding the spring, as well as a drive axle 35 with two wheels 36 extending on either side of the gear box at the ends of the axle. At the forward end of the chassis 31, there is a housing 37 for a magnet/wheel holder 38. A vehicle body 39 is provided that attaches to the top of the chassis 31 and covers the motor gear box 33. In this embodiment, the vehicle body 39 takes the form of an autobus.

As seen more clearly in the detailed exploded view, FIG. 2A, the housing 37 forms a hollow cylindrical sleeve 40 into which a cylindrical body of a magnet/wheel holder 38 is inserted. The magnet/wheel holder 38 is maintained in the housing sleeve 40 with a fastener 41, such as a large head screw, but the magnet/wheel holder 38 is able to rotate and slide up and down in the housing sleeve 40. The housing sleeve 40 has a V-shaped notch 42 on either side of the forward direction of travel of the vehicle for supporting a centering shaft 43. The centering shaft 43 passes through the upper end of the magnet/wheel holder 38 and extends to both sides of the sleeve 40 to rest in the V-notch 42. At the low point of the V-notch, with the centering shaft 43 supported at that point, the magnet wheel holder 38 is positioned to maintain the direction of travel of the vehicle in the forward center direction of the vehicle. At the bottom end of the magnet/wheel holder 38, there is a front wheel axle 44 that holds the wheel 45 in position at the bottom of the holder 38. The wheel axle 44 is perpendicular to the

direction of travel of the wheel, and also intersects the pivot axis of the magnet/wheel holder 38. The magnet/wheel holder 38 also has a forward projecting arm 46 extending from its base, at the distal end of which, a magnet 47 is located on the bottom side of the arm 46. The bottom surface of the magnet 47 is positioned at a height approximately the same as the bottom of the forward wheel 45 such that the magnet glides in close proximity to, or on, the surface of the play board on which the vehicle is traveling.

The steering mechanism for the toy vehicle has a self-centering feature. The centering shaft 43 is positioned high enough in the magnet/wheel holder 38 so that when the vehicle 30 is sitting or traveling along a play board, the centering shaft 43 is pushed above the bottom of the V-notched support 42, as shown in FIG. 2C. When the toy vehicle 30 is lifted off of the play board, the magnet/wheel holder 38 slides down and the housing sleeve 40, the centering shaft 43 hits the V-notch shape 42. Gravity will cause the centering shaft 43 to follow the edge of the V-notch 42 down to the bottom point of the V-notch, as shown in FIG. 2B. As mentioned previously, the bottom point of the V-notch 42 is set perpendicular to the direction of travel so that with the perpendicular centering shaft 43 located there, the wheel 45 will center automatically to the forward direction for travel of the vehicle when the vehicle is lifted off of the play board. When the vehicle is on the play board, however, the centering shaft 43 is pushed up above the edge of the V-notch 42 to allow the wheel 45 to turn left or right freely.

FIG. 3 depicts a third embodiment of a magnetically guided toy vehicle 50. This toy vehicle 50 has a body 51 in the form of a train, and includes a chassis 52 that holds a windup motor gear box 53 at the rear end. At the forward end of the chassis 52, there is located a front wheel housing 54, which is a substantially cylindrical sleeve in the chassis. The magnet and front wheel holder 55 has a cylinder 56 at the top that slides up into that housing sleeve 54 and is maintained by a fastener 57, such as a screw with a large head. At the bottom end of the magnet and wheel holder 55, there is an open yoke 58 through which the wheel 59 and wheel axle 60 are located. There is an arm 61 projecting forward of the magnet and wheel holder 55 that dips down to provide at the distal end a magnet

support 62 under which a magnet 63 is affixed. The magnet 63 is affixed at a position such that the bottom surface of the magnet is approximately the same height as the bottom surface of the front wheel so that both the magnet 63 and wheel 59 travel in close proximity of the play board 64 on which the toy vehicle is traveling. The toy vehicle 50, in this case a train, also includes a train body 51 which is affixed over on top of the chassis 52. As can be seen, the forward placed magnet 63 can ride along a printed metal line 65 in the center of parallel railroad tracks 66 on a play board 64.

As one skilled in the art may appreciate, with the variety of toy vehicles that may be made in accordance with the invention, there are also a correspondingly larger number of play boards with ferromagnetic guide paths that may be manufactured to go along with the toy vehicles as a play set.

For example, FIG. 4 depicts a play board 70 with a ferromagnetic guide path 71 underneath a graphic image of footprints 72 in a seemingly meandering maze pattern. The toy vehicle in this case is a robot figurine 73 that travels along the footprints by a spring windup motor driven drive wheel or even an electric motor. The robot has elongated feet 74 that provide the housing for the drive wheels and the front wheels/magnet assembly similar to the embodiments of toy vehicles described above.

FIG. 5 depicts a play board 75 for a train set. On the surface of the play board there is a printed train track 76 making a complete overlapping and curved circuit on the play board. In between the printed train tracks, there is a ferromagnetic line 77. This line is the guide path for the magnet 78 located on the forward projecting arm of the front wheel housing of a toy vehicle, such as a train shown in this figure. The play board 75 may include fanciful landscaping 79, houses 80 and even 3-dimensional buildings and other structures, such as a train station 81.

FIG. 6 depicts a perspective view of a play board 82 that includes a roadway 82 traveling through a variety of geographical landscapes. Under the roadway there is a ferromagnetic line 84 that provides the guide path for the toy vehicle 85. The play board 82 may be a printed paper or Mylar sheet with fanciful

landscaping and indicating a variety of terrain. Also, 3-dimensional structures may be added to the game board, such as bridge railings 86 as shown.

FIG. 7 depicts a perspective view of another embodiment of a play board 87 having a ferromagnetic line 88 on the play board that provides a guide path for the magnetically guided toy vehicle 89 to follow. In this embodiment, in addition to the graphic image of fanciful landscaping, three-dimensional objects are provided that may be formed by vacuum-forming a top plastic layer that is affixed to a play board substrate. The vacuum-formed layer may include projections such as a volcano 90, or mountain, a house 91, or a water tower 92, as shown.

FIG. 8 shows an exploded view of yet another embodiment of a play board 93. This play board 93 is in the form of a storybook. The storybook 93 includes rigid pages 94 on which a ferromagnetic guide path 95 is located. A magnetically guided toy vehicle 96 may then travel along those magnetic lines 95 as the story 96 printed on the story play board is read to a child by his parents or other caregivers.

Having described a few examples of play boards having ferromagnetic guided paths and tracks on them, it may be apparent that there are a variety of processes that may be used to manufacture such boards. The present invention provides an efficient cost effective and simple method for manufacturing play boards that take advantage of silk screening a ferromagnetic ink to form the ferromagnetic guide path or track for the toy vehicles. Silk screening has the advantage of allowing relatively high-speed mass production and depositing a sufficiently thick layer of ferromagnetic ink that is capable of attracting the guide magnet of a toy vehicle being propelled along the ink track. Although it is believed that roller printing or offset lithography techniques could be adapted to apply the ferromagnetic ink guide path, silk screening is the presently preferred printing technique for this application.

FIG. 9 depicts exploded cutaway views of various play boards made according to different processes. FIG. 9A shows a three-layer play board 100. The bottom play board substrate layer 101 may be paper, cardboard, plastic, or other rigid material. The substrate may include multiple layers such as paper

laminated to a rigid support. Immediately on top of that substrate layer 101, a graphic image 102 is printed using regular ink materials. Preferably, an offset printing method is used. On the top layer, a ferromagnetic ink material 103 is silk screened as an overprint on top of the graphic in a path or track pattern for the toy vehicle to follow. This embodiment of a play board 100 has no protection layer or coating on top of the ferromagnetic ink to protect it. However, this enables the ferromagnetic ink to directly contact the magnet of the magnetically guided toy vehicle. Thus, it is believed that this embodiment would have the best performance in terms of vehicle operation. However, it is realized that over time, direct contact of the ferromagnetic ink with the magnet and other objects may cause some wear and tear and perhaps rub off or dislodge some of the ferromagnetic ink tracks.

Accordingly, as shown in FIG. 9B, an additional process step is provided to add a top surface protection layer over the ferromagnetic ink tracks. In this embodiment, a thin layer 109, such as polypropylene clear material, is laminated to the top of the play board 105 having the ferromagnetic ink tracks 108 that were silk screened over a graphic image 107 printed on a paper substrate 106. Alternatively, a clear-coat polymer varnish may be applied over the ferromagnetic ink guide path 108 for protection.

While the first two embodiments for the process for making the play board may have the best performance, in both embodiments the ferromagnetic ink layer is visible to an ordinary user of the play board. The natural color or dominant color of the ferromagnetic ink may be undesirable depending on the chosen fanciful decorations and landscaping for the play board. Accordingly, some alternative embodiments are provided to provide a play board with hidden ferromagnetic tracks.

As shown in FIG. 9C, a play board 110 is provided with such hidden ferromagnetic ink tracks. On one surface of a paper substrate 113, a graphic image 114 of a landscape or other fanciful imagery set is offset printed. On the reverse side of the surface or paper, the ferromagnetic ink 112 is silk-screened in lines or tracks that are desired. Over the ferromagnetic ink tracks, a polypropylene

clear layer 111 is laminated to protect the ink from being scratched off. Because the graphic image 114 and the ferromagnetic ink tracks 112 are on opposite sides of a solid non-transparent substrate 113, the dark color of the ferromagnetic ink does not effect the graphic image 114 seen by a user playing with this play board. However, the user of the play board will see the tracks 112 when the board 110 is turned over, upside down, rather than its normal position for playing.

Accordingly, another embodiment of this invention provides for a play board that has a completely hidden magnetic ink track. As shown in FIG. 9D, a play board 115 is provided that has a paper substrate 119 with a graphic image 120 of a landscape or other fanciful decoration for playing on. The graphic image 120 is printed by offset printing on one side of the paper. On top of the graphic image 120, a UV varnish 121 or other clear overcoat may be provided to protect the graphic image from fading. On the reverse side of the paper substrate 119, the ferromagnetic ink tracks 118 or guide paths are screen printed. Over the screened ink tracks 118, a solid paper layer 116 is glued 117 to the substrate 119 thereby sandwiching the ferromagnetic ink tracks 118 between two solid, non-transparent layers of paper 116, 119. This embodiment is designed to prevent the ferromagnetic ink tracks 118 from being exposed from either surface of the game board. An additional advantage of this embodiment is that it adds to the mystery of the product with the ferromagnetic ink tracks not being visible. Accordingly, play boards can be manufactured in which a change in the travel direction of a toy vehicle on the play board is not apparent to a user. Another alternative, is that the ferromagnetic ink be silkscreened directly on the substrate and a graphic image printed over the ferromagnetic ink to provide some medium of protection to the ferromagnetic ink tracks, as well as hiding the tracks. It should be apparent, based on the foregoing description, that when the ferromagnetic ink is printed on the top side of the substrate, such as hard card stock, the thickness of the substrate does not affect the performance of the magnetically guided toys. On the other hand, when the ferromagnetic ink is printed on the reverse side of the substrate, it is preferred that the substrate be as thin as possible, such as paper, to keep the ferromagnetic ink as close as possible to the guiding magnet in the toy.

The above embodiments have been described as using a ferromagnetic ink. By the term "ferromagnetic ink", it is intended to refer to any ink containing components capable of attracting a magnet. Accordingly, this term is intended to include inks containing iron or any other material capable of exhibiting similar magnetic attracting characteristics.

The ferromagnetic ink material used in this invention is preferably a compound of electrolytic iron powder blended with different kinds of adhesives or ink vehicles. Depending on the type of adhesive or ink vehicle used, it can be classified as either water base or oil base ink. The water base ink preferably contains mainly boiled water and starch, whereas the oil base ink preferably is a mixture of lacquer rubber and synthetic rubber. The ideal ratio of iron powder to the adhesive is about 1:1 or 1.5:1 by weight. However, in embodiments where the ferromagnetic ink is not in direct contact with the magnet of the vehicle, for example, where the ferromagnetic ink tracks are screened on the reverse side of the paper substrate, then the iron powder content of the ink should be increased. This ratio is likely to vary depending on the particular application and the thicknesses of the substrates used, as well as the strength of the magnet used in the toy vehicles.

Because it is the iron powder that dominates the magnetic strength of the ink, the fineness and purity of the iron powder believed to be important. The iron powder used in a preferred embodiment of the ink has an average fineness of 30 microns per particle diameter, and less than 0.5% of its contents are foreign elements. A chemical analysis of the iron powder shows the following elements in percentage by weight:

Element	Total Fe	Carbon	Phosphorous	Sulfur	Silicon	Maganese	H ₂ Loss
Percentage	≥ 99.5	< 0.005	< 0.002	< 0.01	< 0.005	< 0.0015	< 0.1

The exact amount of iron powder and ink depends on the process for making the play board. The more iron powder that is used, then the stronger the attraction to the toy vehicle will be. However, the increase in iron powder lowers

the screenability of the ink. For example, FIG. 11 depicts a play board that was printed with ink having iron powder up to 40%. Generally, if the quality of the components is high, then the ink has good printability and magnetic effect. An ink containing iron powder in the range of 50-60% also has demonstrated good printability and magnetic effect.

The ink may include other ingredients depending on the substrate that the ink is to be screened on. The ferromagnetic ink can be applied to numerous materials used as the substrate for the play board. These substrates include but are not limited to paper, card stock, plastic, fabric and leather. Conventional adhesives or ink vehicles typically used for screen printing inks on the substrates are believed to be applicable with the ferromagnetic ink in accordance with the present invention.

In addition to toy vehicles that travel along ferromagnetic ink tracks on a play board, one skilled in the art may envision other objects that travel on play boards having ferromagnetic ink tracks. For example, FIG. 10 depicts a moving toy dinosaur 126 on a play board 125. In this case, the play board 126 is printed with landscape and a variety of other miscellaneous objects on the terrain, such as tree stumps, bones and rocks. The ferromagnetic ink tracks are hidden in this play board. In one version, the object is a windup toy dinosaur that travels along the play board following the hidden tracks. In another version, the ferromagnetic ink is deposited as spots randomly distributed on the play board and the toy dinosaur 126 includes magnetically activated switches that turn on and off different functions.

For example, the switches can cause the legs 128 of the dinosaur to move back and forth to imitate a walking movement. In this case, the dinosaur is supported by a platform 127 underneath the belly of the dinosaur that supports the dinosaur and allows the legs to swing back and forth. When the dinosaur is pushed or driven across the play board and crosses the path of a randomly deposited ferromagnetic ink, a magnetic switch in the dinosaur is activated to cause the legs to move. Other functions that may be desirable in the toy dinosaur 126 include a mouth 129 that opens and closes in response to traveling across

certain ferromagnetic ink spots hidden below the play board. Another magnetically switched function may be a tail 130 of the dinosaur that swings back and forth.

Still yet another possibility includes placing magnetically actuated switches in the toy dinosaur that will be activated by magnetic objects other than in the play board. For example, as shown in FIG. 10A, a second toy dinosaur 131 may include hidden magnets under the skin and the upper body of that dinosaur. When the second dinosaur then approaches the first dinosaur as shown in FIG. 10A, and the magnets in the second dinosaur come in close proximity with the head of the first dinosaur, a magnetic switch in the first dinosaur's head would cause the first dinosaur's mouth to open and close and a microchip circuit to activate a voice in the form of a dinosaur scream.

Based on these few illustrations, a person skilled in the art should be able to apply these teachings to come up with other features and other types of toy objects or toy animals that can be animated through the use of ferromagnetic ink tracks and spots in play boards and in other objects. For example, FIG. 11 depicts a playboard with a graphic image of both land and water scapes. Ferromagnetic ink tracks travel in circuitous path both over the land and water. While toy boats and cars may follow these, animals and fish toys may also be made to follow the tracks.

The toy vehicle of this invention has the advantage that the special forward wheel and magnet assembly are advantageously positioned so that they can easily rotate around sharp corners and tight turns of a ferromagnetic ink track on a play board. Another feature of the forward wheel assembly is that it can oscillate up and down to follow the contours of a ferromagnetic ink surface, as well as the changes in the surface due to the built up thicknesses of various layers of ink or graphics applied. Another advantage of the toy vehicle in a preferred embodiment is that the front wheel returns to the center position automatically when the toy is lifted up off the surface of the play board.

Advantages of the embodiments for the method of making the play boards include that conventional screen printing techniques may be used to apply the

ferromagnetic ink tracks. Since these ink tracks may be applied to a thin paper substrate, printing a fanciful design or decorative graphic image on that substrate is also relatively simple following conventional offset printing techniques.

Accordingly, the methods of these inventions allow for high speed mass
5 production of game boards in large volume quantities. Another advantage of the process of this invention is that the play boards themselves may be on the paper wrapping that the toy vehicles are packaged, boxed or bagged in.

Although a variety of embodiments of the invention have been described
10 above, those embodiments are intended only to illustrate and provide examples of the invention. The invention is to be defined, however, not by those illustrative embodiments, but rather by the appended claims that follow, and their equivalents.

CLAIMS

1. A method of making a play board for a magnetically guided toy, the method comprising:
 - a) providing a substrate;
 - b) printing a graphic image on the substrate; and
 - c) printing ferromagnetic ink over the substrate to form a guide path for the magnetically guided toy to follow.
2. The method of claim 1 wherein the guide path is printed using silk screening techniques.
3. The method of claim 2 further comprising applying a protective layer over the guide path.
4. The method of claim 3 wherein said protective layer is a polypropylene film laminated over the guide path.
5. The method of claim 1 further comprising printing a story on the substrate, and binding the substrate in a book.
6. The method of claim 1 further comprising affixing said substrate to a rigid support.
7. A method of making a playboard for a magnetically guided toy, the method comprising:
 - (a) providing a substrate;
 - (b) printing a graphic image on a first side of the substrate;
 - (c) silkscreening a ferromagnetic ink on a second side of the substrate to form a guide path for the magnetically guided toy to follow; and
 - (d) applying a clear protective layer over the second side of the substrate.

8. The method of claim 7 further comprising applying a U.V. protective coating over the graphic image.

9. A method of making a play board for a magnetically guided toy, the method comprising;

- 5 (a) providing a substrate;
- (b) printing a graphic image as a first side of the substrate;
- (c) silkscreening a ferromagnetic ink on a second side of the substrate to form a guide path for the magnetically guided toy; and
- 10 (d) adhering an opaque sheet over the guide path and to the second side of the substrate.

10. The method of claim 9 further comprising applying a U.V. protective coating over the graphic image.

11. The method of claim 9 wherein the substrate is paper.

12. The method of claim 9 wherein the opaque sheet is paper.

13. The magnetically guided travelling toy comprising:

- a body;
- two motor driven wheels at a back end of the body; and
- a magnetically guided wheel assembly at a front end of the body;

20 the wheel assembly including a magnet/wheel holder pivotably coupled to the body, a forward projecting arm, a magnetic disposed to the underside of the arm at a distal end, and one wheel with an axis of rotation perpendicular to, and intersecting with the pivot axis of the holder.

25 14. The toy of claim 13 further comprising a front wheel self-centering mechanism coupled with the magnet/wheel holder such that the direction of the front wheel centers in the line of the forward direction of travel when the toy is lifted off of a playing board surface.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
5 April 2001 (05.04.2001)

PCT

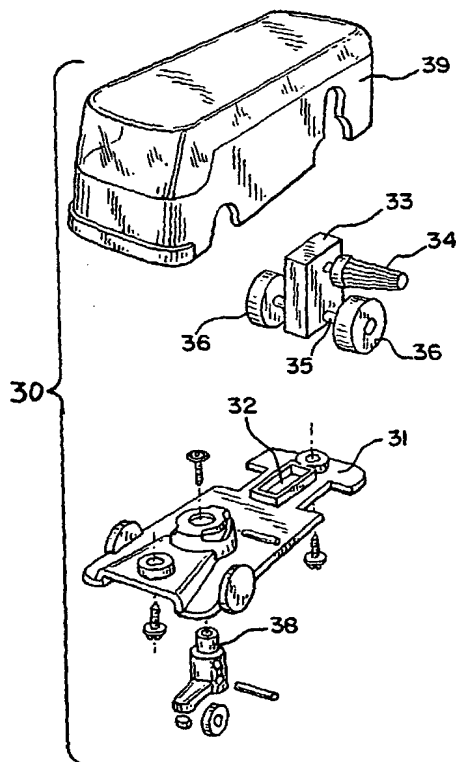
(10) International Publication Number
WO 01/23058 A3

- (51) International Patent Classification⁷: **A63H 33/26** (72) Inventors; and
(21) International Application Number: **PCT/US00/26572** (75) Inventors/Applicants (for US only): **FEKETE, Ferenc** [US/CN]; 2/F, 99A Main Street, Yung Shue Wan, Lamma Island, Hong Kong (CN). **FUNG, Thomas, W., T.** [—/CN]; 12/F, Flat G, Kwun Hoi Mansion, Lei King Wan, Hong Kong (CN). **KRONBERGER, Warren** [US/US]; 8955 E. Condor Court, Minooka, IL 60447 (US).
(22) International Filing Date: 27 September 2000 (27.09.2000)
(25) Filing Language: English
(26) Publication Language: English
(30) Priority Data: 60/156,463 27 September 1999 (27.09.1999) US (74) Agent: **RICHARDS, Marc, V.**; Brinks Hofer Gilson & Lione, P.O. Box 10087, Chicago, IL 60610 (US).
(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application: US 60/156,463 (CON) (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
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[Continued on next page]

(54) Title: **FERROMAGNETIC INK TRACKS AND TOYS AND PROCESSES FOR MAKING THE SAME**

(57) Abstract: The present invention, in one embodiment, provides a magnetically guided travelling toy that includes a vehicle body (39), wind-up gear box (33), a knob (34), a drive axle (35) with two wheels (36) extending on either side of the wind-up gear box (33), a chassis (31), a mounting bracket (32), and a wheel/magnet holder (38).



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FIG. I

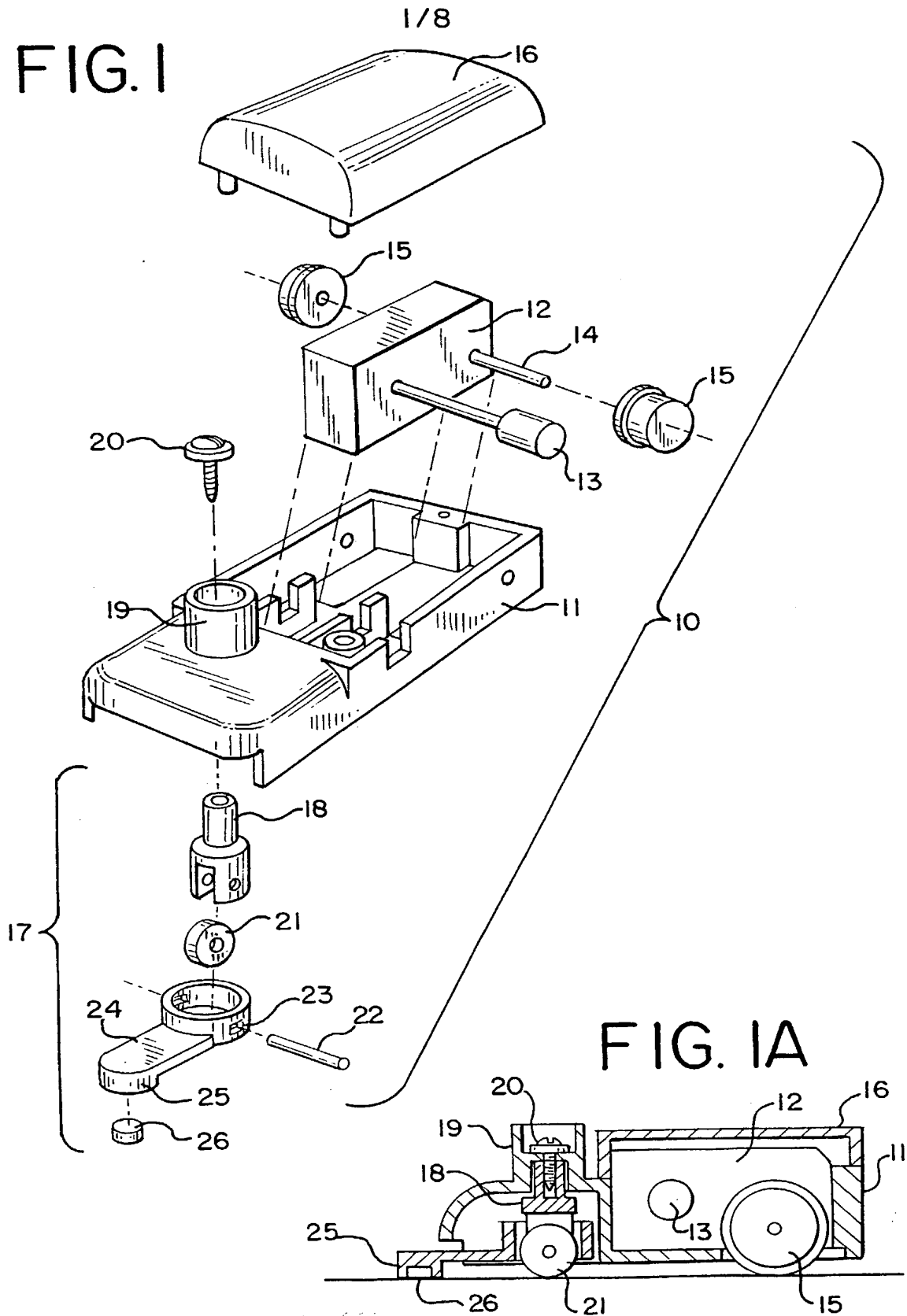


FIG. IA

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FIG. 2

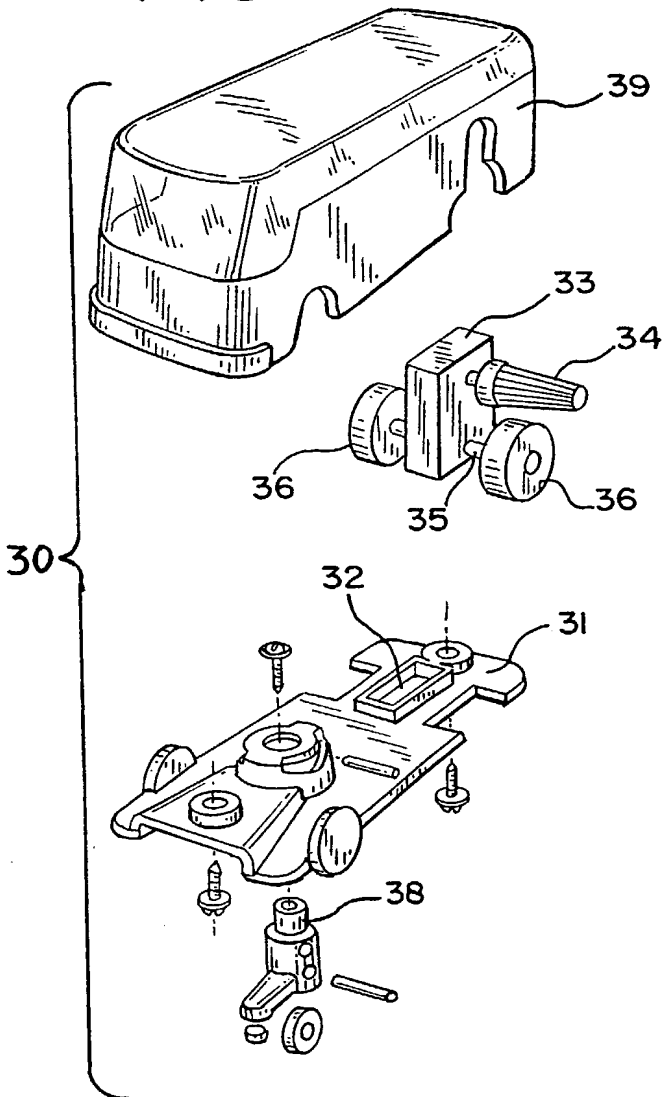


FIG. 2A

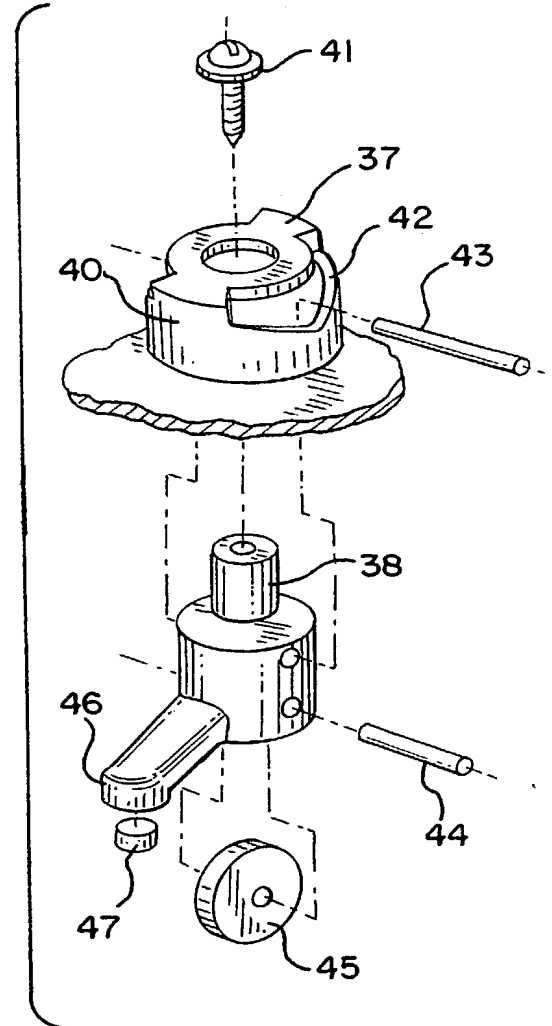


FIG. 2B

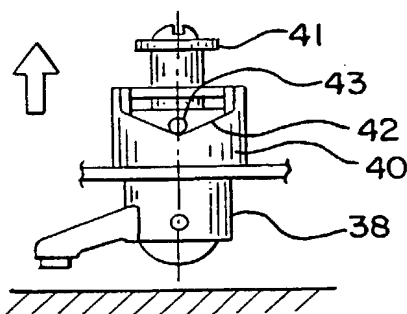
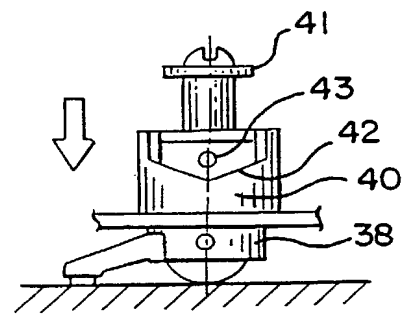


FIG. 2C



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FIG. 3

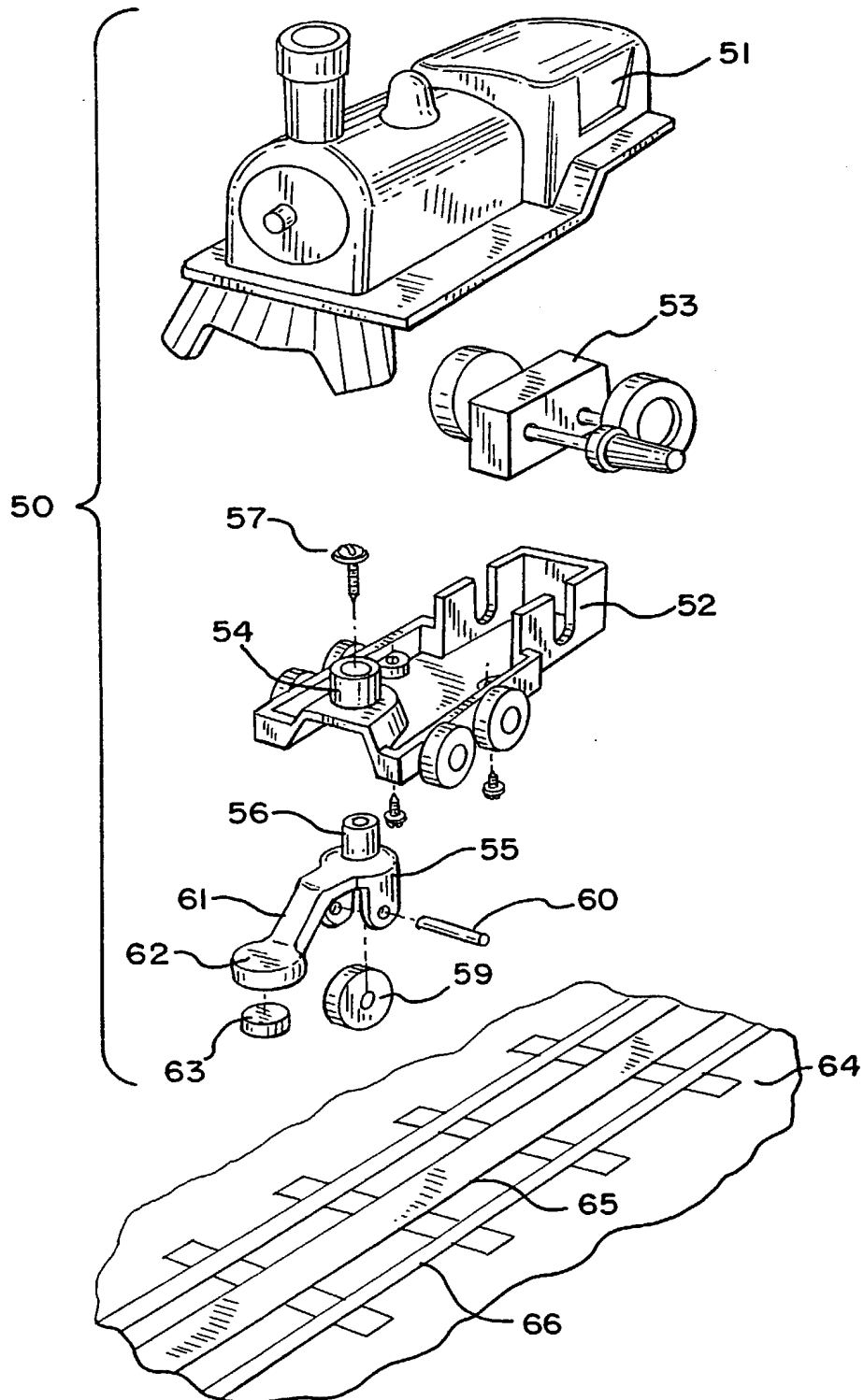


FIG. 4

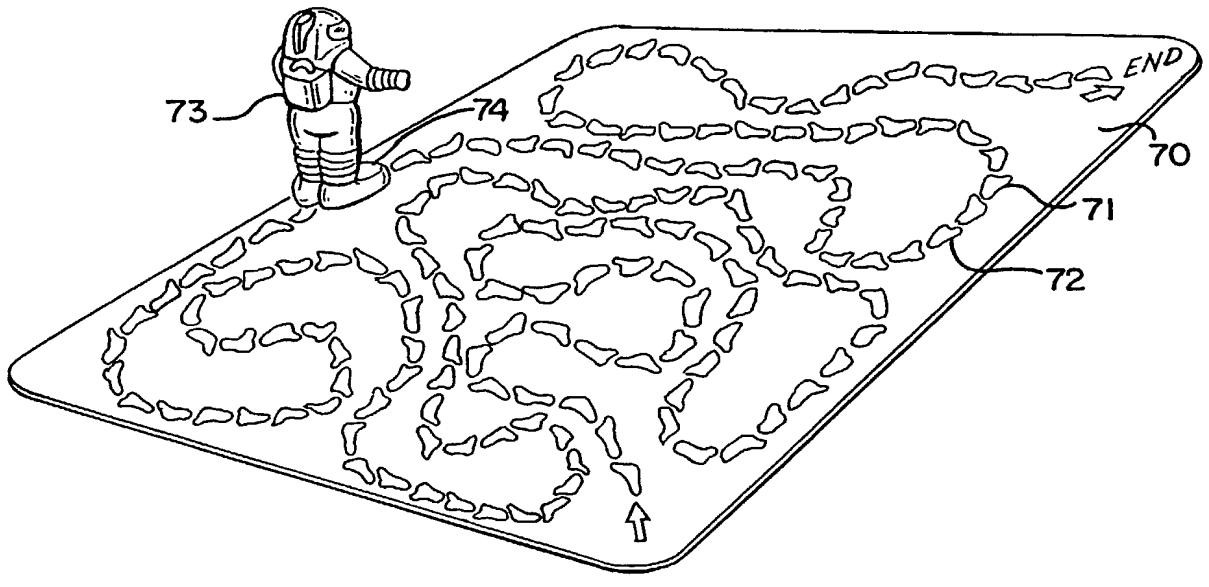
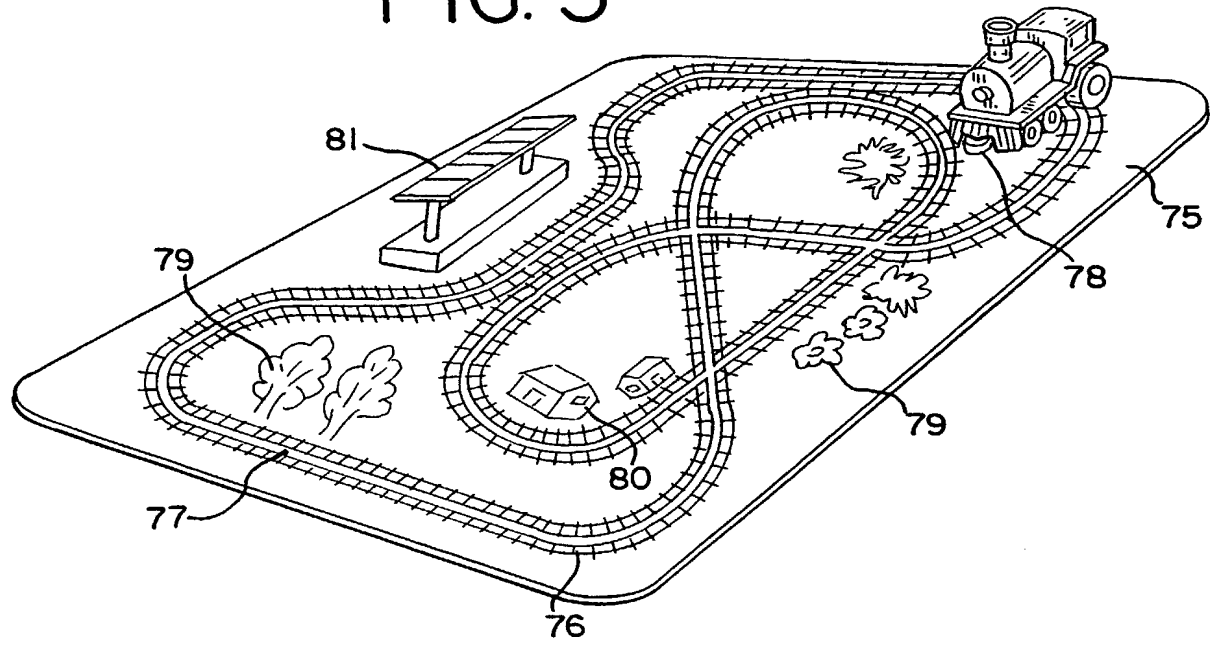


FIG. 5



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FIG. 6

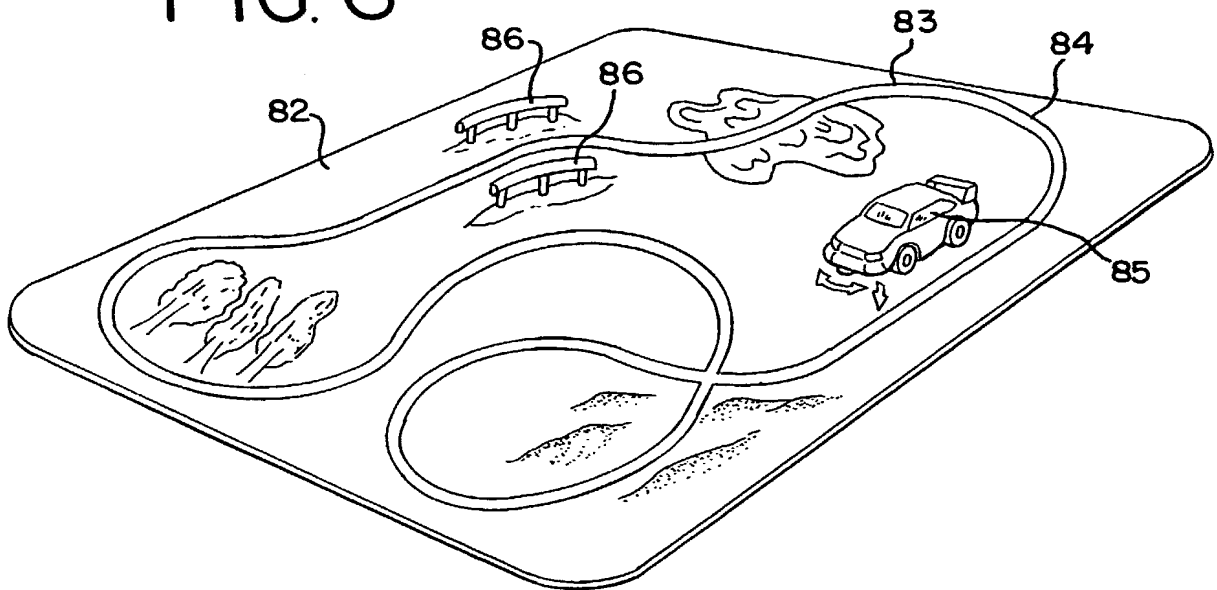
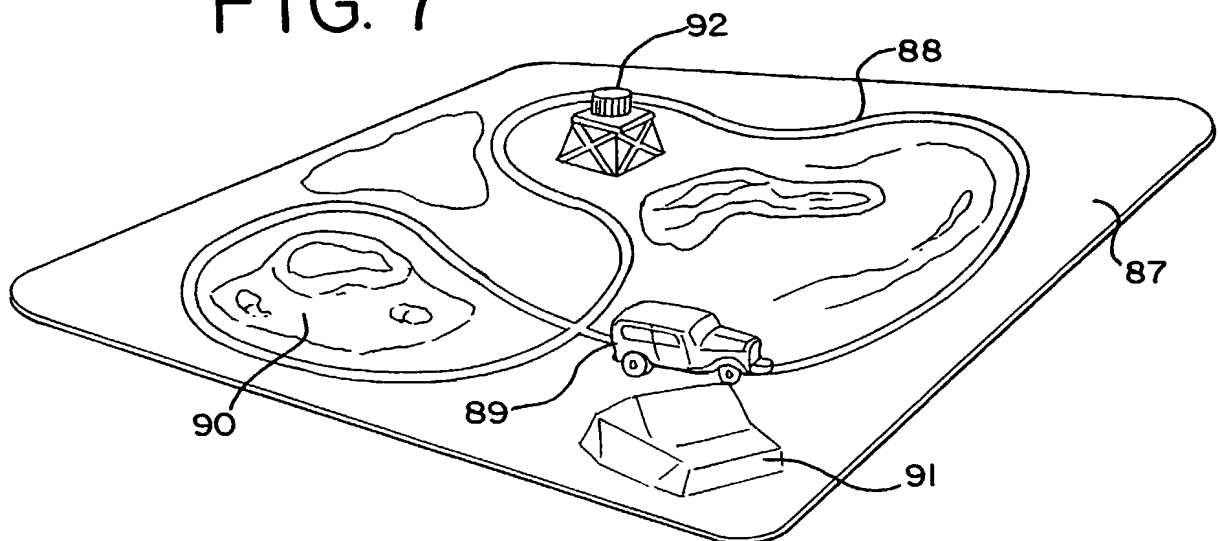


FIG. 7



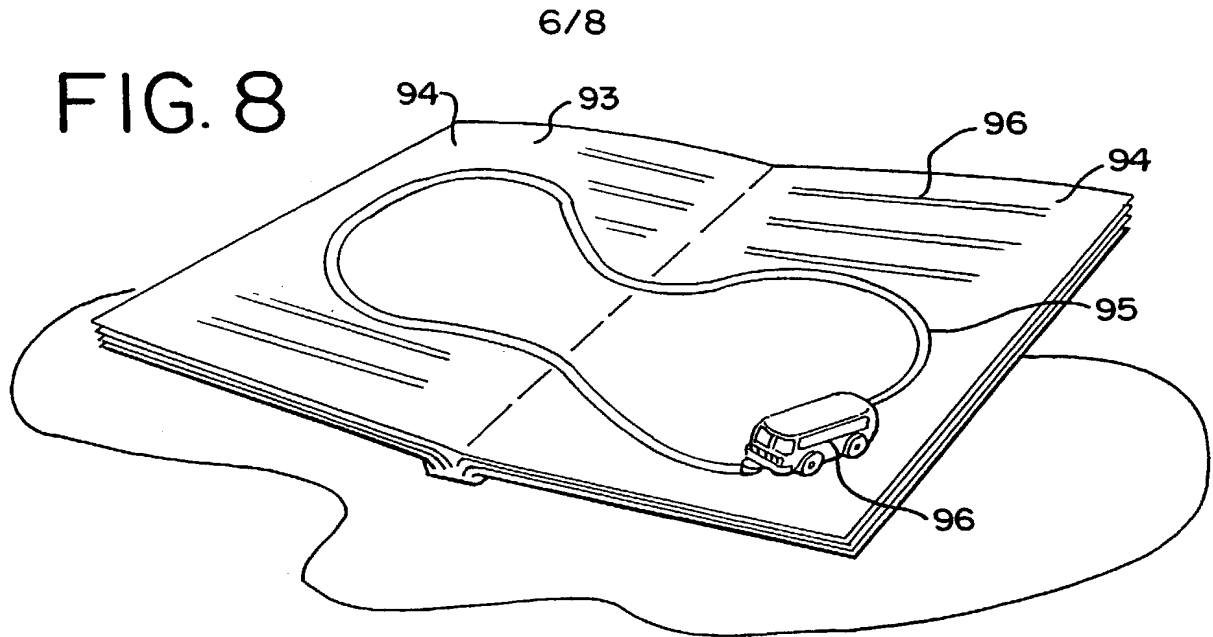


FIG. 9A

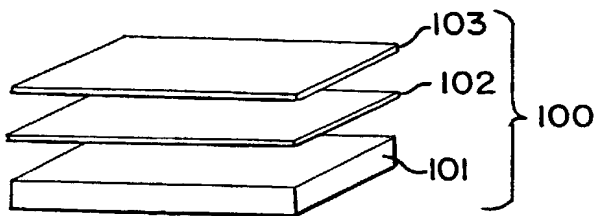


FIG. 9B

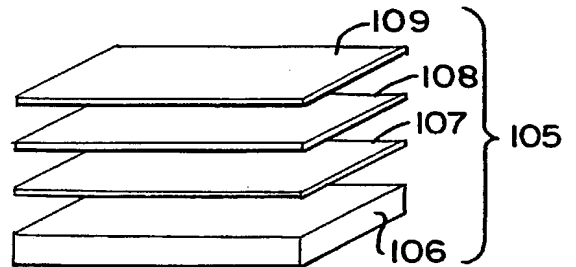


FIG. 9C

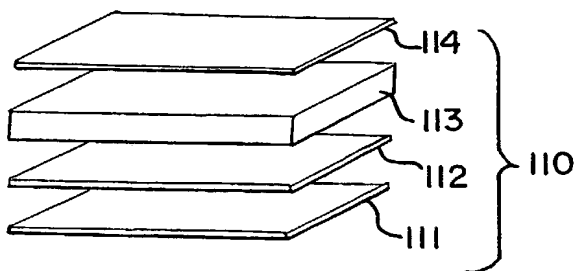


FIG. 9D

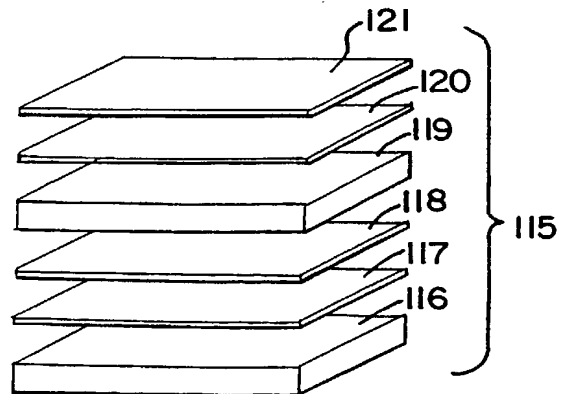


FIG. 10

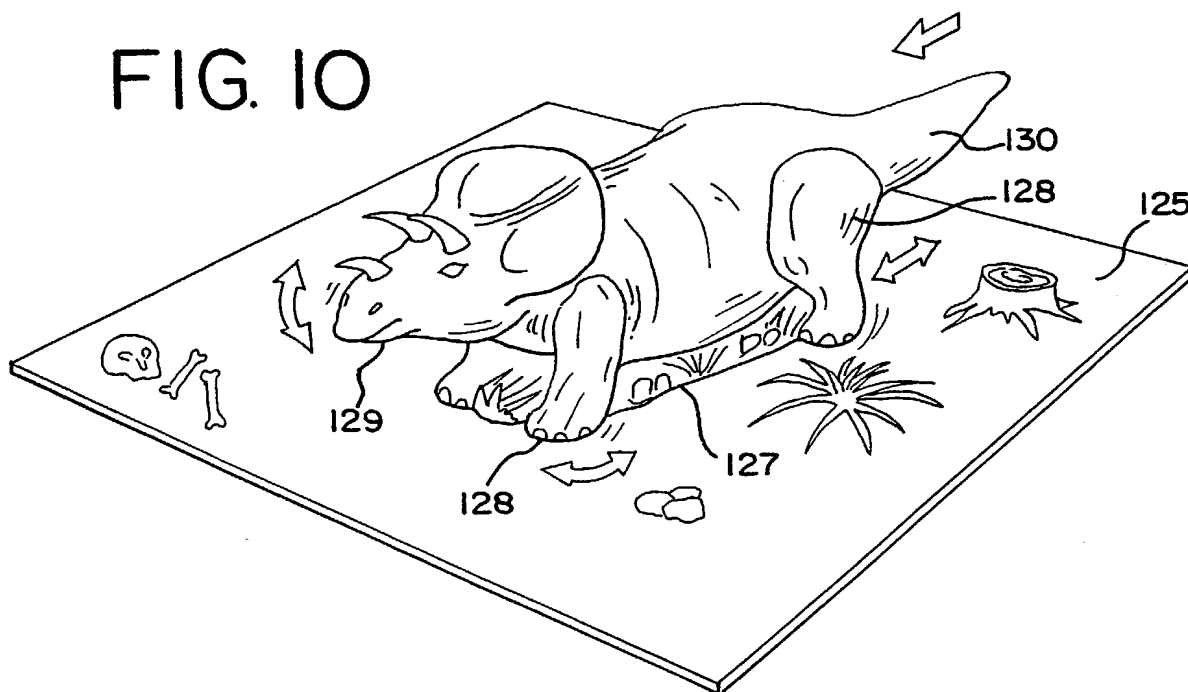


FIG. 10A

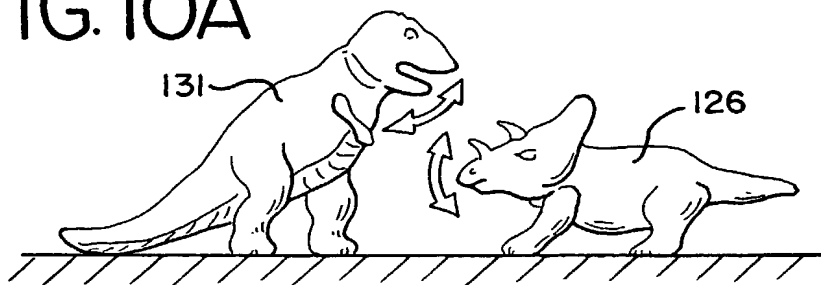
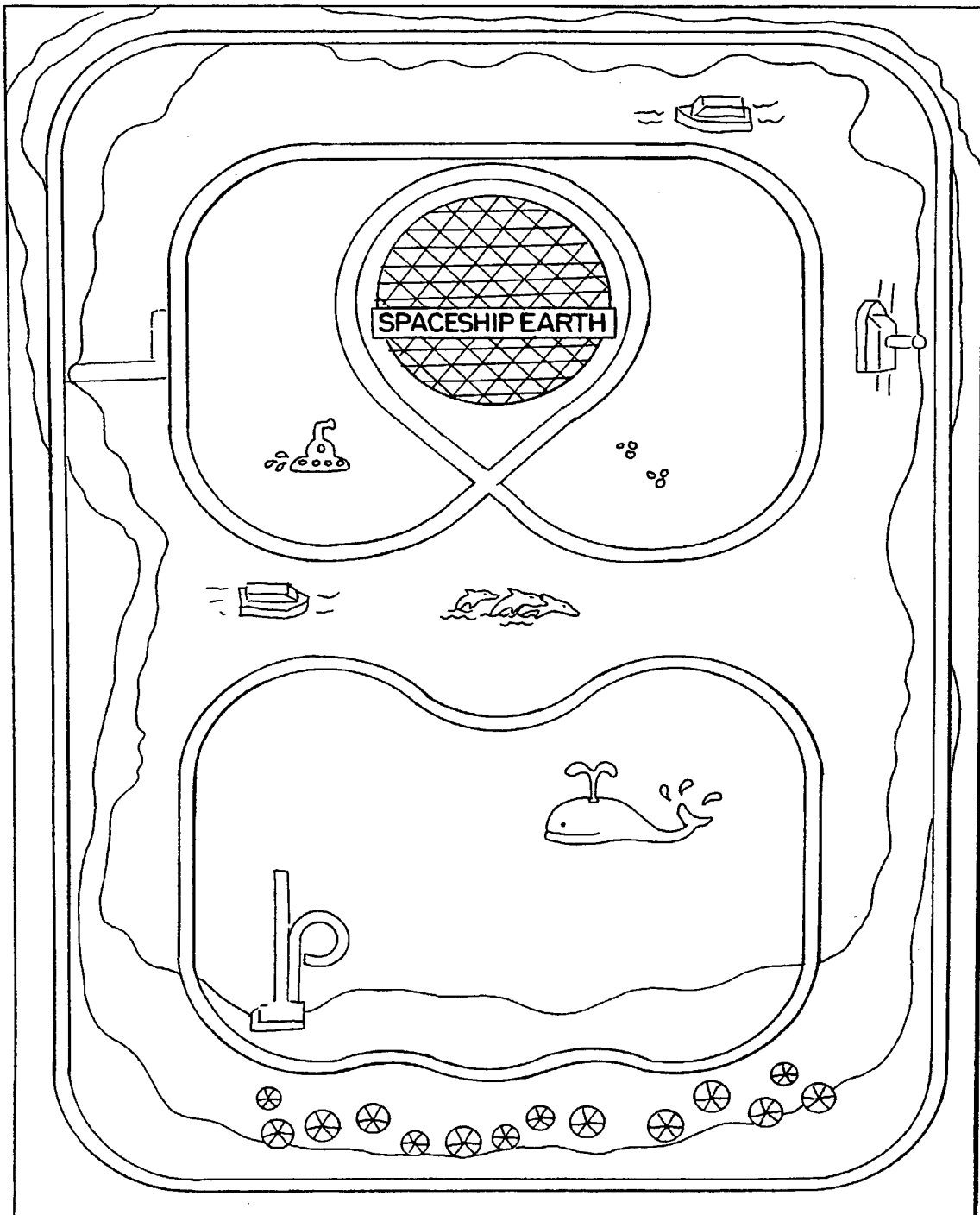


FIG. II



DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled Ferromagnetic Ink Tracks and Toys and Processes for Making Same, the specification of which:

- ☐ is attached hereto.
☒ was filed on March 26, 2002, as Application Serial No. 10/089,246.
☐ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

_____	_____	_____	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

_____	_____
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

<u>PCT/US00/26572</u>	<u>27 September 2000</u>	<u>Pending</u>
(Application Serial No.)	(Filing Date)	(Status-patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Citizenship	<u>CNY</u>	
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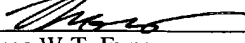
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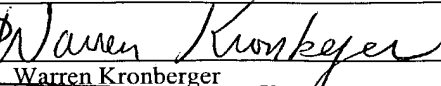
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